Forest Insect
& Disease
Leaflet 129

U.S. Department
of Agriculture
Forest Service

Ips Bark Beetles in the South

Michael D. Connor[1] and Robert C. Wilkinson[2]

F-703108

Courtesy of Jerry Lenhard, Research Associate, Louisiana State University.

There are three principal species of *Ips* bark beetles (Coleoptera: Scolytidae) attacking pines in the Southern United States: the eastern six-spined engraver, *Ips calligraphus calligraphus* (Germar); the eastern five-spined engraver, *Ips grandicollis* (Eichhoff); and the small southern pine engraver, *Ips avulsus* (Eichhoff). From 1973 to 1979, these *three Ips* species caused the loss of an estimated 6.6 million board feet and 1.1 million cords of pine timber in the South.[3] The only insect to kill more pine timber in the South is the southern pine beetle, *Dendroctonus frontalis* Zimmermann, which often attacks trees in combination with one or more of the three *Ips* species, and the black turpentine beetle, *Dendroctonus terebrans* (Olivier).

[1]Entomologist, USDA Forest Service, Southern Region, State and Private Forestry, Forest Pest Management, Pineville, La.

[2]Professor of Forest Entomology, Department of Entomology and Nematology, University of Florida, Gainesville, Fla.

[3]Data taken from yearly unpublished reports of the Southern Forest Insect Work Conference, calendar years 1973-79, Survey of Damage Caused by Forest Insects in the Southeast.

Ips beetles usually attack weakened, dying, or recently felled trees and fresh logging debris. Large numbers *Ips* may build up when natural events such as lightning storms, ice storms, tornadoes, wildfires, and droughts create large amounts of pine suitable for the breeding of these beetles. *Ips* populations may also build up following forestry activities, such as prescribed burns that get too hot and kill or weaken pines and clear-cutting or thinning operations that compact soils, wound trees, and leave large amounts of branches, cull logs, and stumps for breeding sites.

Distribution

Two subspecies of *Ips Calligraphus* are recognized: *Ips calligraphus ponderosae* (Swaine) and *Ips c. calligraphus.* The distribution of *Ips c. ponderosae, I. c. calligraphus, I. grandicollis,* and *I. avulsus* within the United States is shown in figure 1. *Ips c. ponderosae* is a western subspecies and will not be discussed further in this leaflet. *Ips c. calligraphus* is primarily an eastern subspecies that occurs naturally from southern Canada to the Gulf of Mexico. A small population has apparently been introduced into California. *Ips grandicollis* is also an eastern species found from Canada south to the Gulf and on some of the Caribbean Islands. Accidental introductions have also established populations in South and Western Australia. *Ips avulsus* is the only species confined almost entirely to the Southern United States.

Hosts

At least 16 species of pines growing in the United States are hosts to

F-703099

Figure 1.—*Distribution of* Ips calligraphus calligraphus, I. c. ponderosae; I. grandicollis, *and* I. avulsus *in the United States.*

one or more of the three *Ips* discussed here. Eleven of these tree species are native to the South (table 1).

Signs of Infestations

Trees attacked by *Ips* bark beetles, whether in the forest or around the home, are usually noticed when needles turn yellow or red. Upon closer examination, infested trees will have dry, reddish-brown boring dust in the bark crevices (fig. 2). Some trees may have dime-size or smaller, white to reddish-brown projections, called pitch tubes in the bark crevices (fig. 3).

Pitch tubes are a mixture of pitch and bark particles pushed out by the attacking beetles. The center of the tube contains a hole through which the adult beetle enters the inner bark. If no hole is present in the pitch tube, the beetle attack was unsuccessful. Vigorous trees attacked by a few adults often produce enough pitch to either drown the beetles in the inner bark or push them back out of their entrance tunnels. If the bark around a hole containing dry boring dust is carefully cut away, the beetles can often be seen in their tunnels within the inner bark (fig.4).

Adult *Ips* beetles carry numerous spores of a bluestain fungus, *Ceratocystis ips* (Rumbold) C. Moreau, in their gut. When the adults attack trees or logging slash, the bluestain spores are excreted with beetle feces into egg galleries, where the spores germinate. Bluestain fungus colonies grow into the outer sapwood of infested pines, stopping the upward flow of water to the tree crown. Lack of water causes needles to wilt and die, gradually changing their color, from dull green to yellow green to red brown (fig. 5). These color changes may occur in 2 to

Table 1.—*Pine species reported to be attacked by* Ips calligraphus calligraphus, grandicollis, *and* avulsus *in the United States.*

Pine species		*Ips* species		
Common name	Scientific name	*calligraphus*	*grandicollis*	*avulsus*
Digger pine	*Pinus sabiniana* Doug.	X		
*eastern white pine	*P. strobus* L.	X	X	X
jack pine	*P. banksiana* Lamb.		X	
*loblolly pine	*P. taeda* L.	X	X	X
*longleaf pine	*P. palustris* Mill.	X	X	X
*pitch pine	*P. rigida* Mill.	X	X	X
*pond pine	*P. serotina* Michx.	X	X	X
ponderosa pine	*P. ponderosa* Laws.	X		
red pine	*P. resinosa* Ait.	X		X
*sand pine	*P. clausa* (Chapm. *ex* Engelm.) Vasey *ex* Sarg.	X	X	X
Scotch pine	*P. sylvestris* L.	X	X	
*shortleaf pine	*P. echinata* Mill.	X	X	X
*slash pine	*P. elliottii* Engelm.	X	X	X
*spruce pine	*P. glabra* Walt.	X		
*Table Mountain pine	*P. pungens* Lamb.	X		X
*Virginia pine	*P. virginiana* Mill.	X	X	X

*Pines native to the Southern United States.

F-703100

Figure 2.—*Reddish-brown boring dust at the location of a recent* Ips *attack.*

F-703101

Figure 3.—*Pitch tube created by an* Ips *attack.*

4 weeks during the summer, but take several months in the winter.

When *Ips* beetles leave a tree, their emergence holes look like scattered

F-703102

Figure 4.—*Female beetles constructing egg galleries off the central nuptial chamber.*

shot-holes on the surface of the outer bark (fig. 6). During hot weather, beetles usually leave a tree by the time the foliage turns red brown. During either cool or moist weather, the beetles may leave while the foliage is still green. Therefore, the best way to confirm the presence of *Ips* beetles in a tree is to remove several apparently attacked sections of bark to determine if any beetle life stages are present.

Life Stages

Newly emerged adults of the three *Ips* species are light orange brown in color; mature adults vary from dark red brown to almost black. The posterior of *Ips* adults looks as if it has been cut off at an angle and hollowed out. (See cover.) Close inspection with a magnifying lens shows that *Ips* adults have a number

F-703103

Figure 5.—*A pine tree with red needles that has been killed by* Ips *bark beetles.*

of spines on the outer side of each wing cover near the posterior. In the South, most pine bark beetles that could be confused with *Ips* lack spines and have rounded rear ends that are ot hollowed out.

In the adult stage, the three *Ips* species can be distinguished by their size and the number of spines. *Ips calligraphus* adults are about 5 mm (1/5 in) long and have 6 spines on each side near the posterior. Their eggs are oblong, pearly white, and about 1 mm (1/25 in) long by 0.5 mm (1/50 in) wide. The grublike larvae are small, witish, and legless, with orange-brown heads up to 1 mm (1/25 in) wide (fig. 7). The pupae are waxy white and similar to adults in size. The eastern six-spined engraver commonly infests thick-barked pines and usually attacks portions of trunks that are 10 cm (4 in) or more in diameter. This is often one of the first bark beetles to attack drought-stricken trees.

F-703104

Figure 6.—Ips *emergence holes on the surface of the outer bark.*

Ips grandicollis adults are about 4 mm (1/6 in) long and have 5 spines on each side. The eggs are about 0.9 mm (1/30 in) long by 0.5 mm (1/50 in) wide, and larvae have heads

F-703105

Figure 7.—Ips *larvae in feeding galleries in the inner bark.*

up to 0.8 mm (1/32 in) wide. Pupae are waxy white and similar to adults in size. Recently felled trees and fresh logging debris are favored breeding material. In standing trees, this species is usually found in the upper trunk and basal portions of large branches.

Ips avulsus adults are about 3 mm (1/8 in) long and have 4 spines on each side. The wing covers of *Ips avulsus* are lighter brown than the thorax. The eggs are about 0.8 mm (1/32 in) long by 0.46 mm (1/55 in) wide, and larvae have heads up to 0.7 mm (1/36 in) wide. Pupae are waxy white and similar in size to adults. Fresh, thin-barked logging debris, such as the upper portions of branches and tops of pines, is often infested. The crowns of large, living trees may be attacked and partially or completely killed. It is common to find one or more species of *Ips,* as well as other pine-infesting beetles, inhabiting various parts of the same tree.

Life Cycle

It is usually the male *Ips* that initiates the attacks on living pines or logging debris by boring an entrance tunnel through the outer bark and excavating a small, irregular nuptial chamber within the inner bark. Generally one to four females are attracted to the male beetle in this chamber, where mating occurs. From this chamber, each female then begins constructing an egg gallery (fig. 4). These egg galleries usually follow the underlying wood grain, often resulting in Y- or H-shaped gallery patterns in the inner bark (figs. 8 & 9).

Females lay their eggs in niches that are chewed out at intervals on either side of the egg galleries, and cover them with plugs of inner bark. During warm weather, larvae emerge from the eggs after a few days and make individual tunnels or feeding galleries in the inner bark.

The feeding galleries extend from the niches in the egg galleries, enlarging as the larvae grow. Mature larvae stop feeding, turn chalky white, and pupate at the end of their galleries, or sometimes in rounded pupal chambers. Here the pupae change to young adults. The new or brood adults make short, winding tunnels in the inner bark, consuming bluestain fungus fruiting bodies before maturing and boring out through the bark to repeat the life cycle.

One generation of *Ips* may be completed in approximately 21 to 40 days during the summer or may require several months during the winter. Under warm conditions, the

F-703106

Figure 8.—*Typical Y- or H-shaped gallery pattern of* Ips calligraphus *and* I. grandicollis.

F-703107

Figure 9.—*Typical gallery pattern of* Ips avulsus.

short life cycle allows populations to increase rapidly. Because very little development takes place below about 15° C (59° F), *Ips* are not a serious problem during cold weather.

Integrated Pest Management

Beetle-caused damage can be reduced through one or more prevention or suppression techniques.

Prevention.—An important factor in determining the incidence and severity of *Ips* activity is the amount of suitable host material available for breeding. Forestry practices that reduce the amount of such material help serve as preventive control measures.

The following practices are recommended during logging or thinning operations:

- Use as much of each crop tree as possible. Avoid leaving logging debris in contact with or close to residual pines.
- Remove harvested timber from a stand as soon as possible, especially during warm weather. Whenever feasible, stack harvested timber or pine firewood away from living pines.
- Minimize the damage to future crop trees that is caused by logging equipment and vehicles. When thinning, use the lightest suitable equipment to minimize soil compaction and root-breakage. Scarred portions of trees and root injuries, especially during hot, dry weather, attract *Ips* and black turpentine beetles. Wounds invite infection.

The following practices are recommended when planting and maintaining pine stands:

- Use the pine species and spacing intervals best suited to the area to be planted.

- If necessary, thin stands to maintain vigorous and healthy growing conditions.
- Promptly salvage or destroy potential *Ips* breeding material, such as pines that are severely damaged by wind, lightning, fire, disease, insects, or other destructive agents.

In residential areas, maintain shade tree vigor by watering during periods of drought.

Natural Control.—Several insect parasites and predators, as well as fungus diseases, provide some natural control of *Ips* populations. Woodpeckers sometimes remove *Ips* from the bark, especially during the winter when beetle development is very slow.

Suppression.—Natural disasters such as prolonged droughts, hot wildfires, or severe windstorms sometimes result in large *Ips* infestations despite good preventive forest management. Logging of beetle-infested and recently killed trees through timber sales is often an effective way to reduce bark beetle populations and minimize further timber losses.

Chemical control of *Ips* infestations under forest conditions is seldom warranted. If chemical control is necessary to protect high-value trees in residential or recreational areas, the nearest County Agricultural Extension Agent, State Agricultural Experiment Station, or USDA Forest Service office should be contacted in order to obtain current chemical control recommendations.

Other control methods are burning, chipping, debarking, or burying infested portions of trees. Burning should be restricted to periods of low fire danger, and Federal and State laws should be observed.

Timber Management Practices.—Timber owners may consult their nearest county, State, or Federal forestry personnel for recommendations on tree species selection, spacing, thinning, salvage logging, or other management practices to be followed in a particular stand or area.

References

Baker, W. L. Eastern forest insects. Misc. Pub. 1175. Washington, DC: U.S. Department of Agriculture, Forest Service; 1972: 259-262.

Belanger, R. P. Silvicultural guidelines for reducing losses to the southern pine beetle; In: Thatcher, R. C. et al., ed. The southern pine beetle. Tech. Bull. 1631. Washington, DC: U.S. Department of Agriculture, Forest Service, Science and Education Administration; 1981: 165-177.

Hopping, G. R. North American species in group IX of *Ips* DeGeer (Coleoptera: Scolytidae). Can. Entomol. 97: 422-434; 1965.

Lanier, G. N. Biosystematics of the genus *Ips* (Coleoptera: Scolytidae) in North America. Hopping's groups IV and X. Can. Entomol. 104: 361-388; 1972.

Thatcher, R. C. Bark beetles affecting southern pines: a review of current knowledge. Occas. Pap. 180. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1960, 25 p.

Wilkinson, R. C.; Foltz, J. L. A selected bibliography (1959-1979) of three southeastern species of *Ips* engraver beetles. Bull. Entomol. Soc. Am, 26: 375-380; 1980.

Wood, D. D.; Stark, R. W. The life history of *Ips calligraphus* (Coleoptera; Scolytidae) with notes on its biology in California. Can. Entomol. 100: 145-151; 1968.

Revised October 1983